Crimson Clover.

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CRIMSON CLOVER.

F. E. EMERY, AGRICULTURIST.

I. EXPERIMENTS AT THE N. C. AGRICULTURAL EXPERIMENT STATION.

The use of crimson clover as a soil improver began on the Experiment Farm in the fall of 1889, when it was sown after pea-vines (among the vines) to continue through the winter the work of improvement begun by the pea-vines. Seeds were saved in 1890 by stripping. This method was considered necessary because of the low growth among the stones on the slope which was being improved.

The following year this clover was sown more extensively*. It was sown among pea-vines on the south front of the buildings, and on the northeast where the pea-vines had followed immediately after a soil (fertilizer) test with cotton. It is possible clover had been sown and failed before the pea-vines, but the pea-vines were the first growth after the cotton. The cotton was said to have yielded about 20 per cent. of an average crop. The best yield was where two 2-horse loads of stable manure had been applied to one-twentieth-acre plat; 870 pounds of seed cotton per acre. The old pea-vines showed a more luxuriant growth on this plat, and the clover was fit for hay on April 24th, 1891. The growth of pea-vines and clover over these soil-test plats corresponded very well as shown by notes taken just before plowing. The combinations which were effective in increasing growth were of acid phosphate, kainit, cotton-seed meal. The stable manure was the only single application, the residual value of which seemed to have done the pea-vines and clover much good. Kainit and cotton-seed meal gave a very good growth of both pea-vines and clover; better than a one-horse load of stable manure.

A complete combination of 15 pounds acid phosphate with 7½ pounds cotton-seed meal and 3½ pounds kainit had about the same effect that 10 pounds kainit and 15 pounds acid phosphate had on another plat. All three of these chemicals, applied at rate of 10 pounds each, gave a slightly better growth than did either of the last named, but not equal to one 2-horse load of stable manure.

This shows something of the status of the land and what was required to make it grow clover. A coat of stable manure over

*This beginning was made by J. R. Chamberlain, B. S., Agriculturist. The second year's sowing was done by him as Professor of Agriculture and his students in practice-work.

the parts which showed the need gave good results in a crop of corn* which immediately succeeded this clover.

During 1891 hay was made from crimson clover grown after cow-pea-vines. This hay was fed in several digestion experiments which were reported in Bulletins 87d and 97.

In 1891 a small area, previously in millet and manured, was sown to crimson clover with barley, hoping to use the barley for soiling, but the fall proved too dry for barley and it grew just enough to afford protection for the clover, and in the spring of 1892 these crops came off together and made a very heavy yield of good hay.

In 1892, following a rather poor crop of oats, about 1⅞ tons of stable manure and 1,080 pounds decayed silage were put on the poorer parts of a lot measuring 1⅜ acres, and on August 24th crimson clover was sown after fitting the land well. This was cut for seed May 26, 1893, and proved a very good crop. This seed was distributed throughout the State.†

At the market price for seed in chaff, and estimating the hay as equivalent to the over-ripe pressed hay in the Raleigh market this crop was estimated at $100 per acre.

Following the above crop on a larger scale, about five acres were sown after soy-beans which had been ensiloed. The bean stubble was cut over with cutaway harrow, then black cow-peas drilled in with wheat drill in every third tube, putting the drills two feet apart and crimson clover seed in chaff, sown at the rate of 54 pounds of chaff per acre ahead of the drill. (This was considerable heavier seeding than needed, but sowers could not seem to gage the rate of sowing light enough). Harrowed with smoothing-harrow after sown.

A part of this field was mown and all was grazed in October. The clover and pea-vines were from one to one-and-a-half-feet tall. The following March the most forward part was frozen back severely by the freeze of 27th inst. It was on this portion that the barley and clover above mentioned was grown, and where the mowing was done in October for soiling purposes. This field was ripened for seed from the first crop. A portion of it was storm beaten before cut, but still the yield was profitable.‡

Crimson clover has been grown in alternation with corn to be ensiloed for several years, with varied successes and failures. The latter have been mainly due to hot, dry weather soon after seeding, or when such weather has continued almost the entire fall. One such failure to germinate seed until very late—too late for a satisfactory development of the crop in an ordinary season—proved a success by having been followed by a late, cool, wet spring, that of

*B. 89, p. 27.
†Press B. 51 and 61, also B. 96, p. 80, and B. 103, p. 253.
‡See Press Bulletins 64 and 65, also same matter in B. 115, pp. 165 and 170.

1895. Clover seed was sown in September (12th) among a soiling crop of corn and pea-vines. The seed was in hulls and laid on the surface at least a month before it vegetated and grew. The yield of rather damp hay harvested May 17th to 23d was over 2 1-5 tons per acre.

Since many bulletin readers do not keep files of these articles, and thousands of new names have been added to the station mailing list since the articles referred to above were printed, it is deemed advisable to reprint some of the articles. They are thus given below to new readers and to those who may care to review, without going to the trouble of hunting up lost pamphlets.

‖DIGESTION OF CRIMSON CLOVER HAY BY ONE GOAT AND ONE SHEEP.

(Date of experiment, November, 1891.)

The Preliminary Period for the gray goat was 8 days, and for the hornless sheep 8 days. The goat ate 771.1 grams of hay daily. The sheep ate 399.2 grams of hay per day.

During the Collection Period of 6 days the goat ate 811.9 grams of hay and drank 1129.5 grams of water daily. The sheep ate 403.7 grams and drank 621.4 grams water per day.

The goat weighed one-fourth pound less at the end of the collection period than the average for the 8 preceding days, while the sheep fell off from an average of 53 pounds to 49 pounds at the close of the collection period. The clover hay fed was prepared the same as the corn fodder. An aliquot sample was taken at each feed and preserved in air-tight jars till ready to analyze.

Analytical and Other Data for Obtaining the Coefficients of Digestibility. See Tables III and IV.

The composition of crimson clover hay and the coefficients of its digestibility show it to be a highly nutritious food. To bring out more clearly its nutritive value, comparison is made below with other well known and highly prized leguminous plants in a table showing the actual amounts of digestible nutrients in one hundred pounds of dry matter of each.

	Protein.	Carbohydrates.	Fats.	Ratio 1 to
Alfalfa hay, average of O'Brine* and N. Y. Ag. Ex. Station†	10.55	44.31	1.35	4.52
Alsike clover hay—Jordan‡	9.31	46.96	2.76	5.78
Red clover hay—Armsby§	6.64	42.64	0.80	6.72
Crimson clover hay (this experiment)	12.45	43.70	1.25	3.76

Scarlet clover (Trifolium incarnatum) is known under a variety of common names—Annual, German, Scarlet and Italian. This clover is easily grown, and should come into quite general use. It is an annual, and consequently must be re-seeded for each crop, which makes it important to grow seed at home. Seed may be sown from July to October, but the land should always be well prepared for it, or, if not, it should be well shaded, as under a good growth of cow-pea vines, or in a corn or cotton crop, when the seed should be sown when the crop is laid by. Grown in this way it may be of great service in enriching and holding the land from washing. Its growth is made in the cool, wet part of the year, and it is ready to be made into hay at a season when planters are waiting for cotton to vegetate for first

‖From B. 87d.
*Bulletin No. 8, Col. Ag. Exp't Sta.
†Eighth Annual Report, p. 143.
‡Maine Ag. Exp't Sta., Ann. Rep. 1889, part 2.
§Univ. of Wisc., Ag. Ex. Sta. Bulletin No. 3.

TABLE III.—SHOWING PERCENTAGE COMPOSITION CRIMSON CLOVER, WASTE, AND SOLID EXCREMENT.

	Water.	Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein. (N×6 25.)	Albuminoids. (Alb. N×6.25.)	Fats. (Eth. Ext.)	N-Free Extract.	Crude Fiber.	Total. Sugars.	St'rch
Crimson clover hay	10.85	89.15	9.20	18.01	14.02	2.57	41.67	28.55	2.67	11.14
Waste, crims'n clov'r hay—Gray Goat	10.58	89.42	10.63	19.50	15.65	2.81	39.18	27.88	2.32	10.02
" " —Hornless Sheep	10.83	89.17	9.89	21.73	16.96	2.60	41.07	24.71	2.33	9.95
Solid excrement—Gray Goat	58.43	41.57	10.39	13.86	13 86	3.53	31.70	40.52	....	9.53
" " —Hornless Sheep	53.77	46.23	11.75	14.02	14.02	3.38	31.60	39.25	....	9.81

TABLE IV.—SHOWING NUTRIENTS CONSUMED AND EXCRETED IN GRAMS, WITH PERCENTAGES DIGESTED.

GRAY GOAT.

	Total Am'nt	Dry Matter.	DRY MATTER CONTAINS. Ash.	Protein. (N×6.25.)	Albuminoids. (Alb. N×6.25.)	Fats. (Eth. Ext)	N-Free Extract.	Crude Fiber.	Total Sug'rs	St'rch	Undetermined Carbohydrates
Crimson clover hay fed	5400.	4814.1	442.9	867.0	674.9	123.7	2006.0	1374.4	128.54	536.29	1341.17
" " waste	518.	463.2	49.2	90.3	72.5	13.0	181.5	129.1	10.75	46 41	124.33
Total consumed	4882.0	4350.9	393.7	776.7	602.4	110.7	1824.5	1245.3	117.79	489.88	1216.84
Total solid excrement	4245.5	1764.8	183.3	244.6	244.6	62.3	559.4	715.1	.....	168.19	391.21
Total digested		2586.1	210.4	532.1	357.8	48.4	1265.1	530.2	117.79	321.69	825.63
Per cent. digested		59.44	53.44	68.52	59.39	43.72	69.34	42.57	100.00	65.66	67.85
HORNLESS SHEEP.											
Crimson clover hay fed	3600.0	3209.4	295.2	578.0	449.9	82.8	1337.3	916.3	85.69	357.53	894.08
" " waste	1173.0	1046.0	103.4	227.3	177.4	27.2	429.6	258.5	24.37	104 08	301.15
Total consumed	2427.0	2164.3	191.8	350.7	272.5	55.6	907.7	657.8	61.32	253 45	592.93
Total solid excrement	1638.0	757.2	88.9	106.1	106.1	25.6	239.3	297.2	....	74.28	165.02
Total digested		1406.2	102.9	244.6	166.4	30.0	668.4	360.6	61.32	179 17	427.91
Per cent. digested		65.00	53.65	69.75	61.06	53.96	73.63	54.82	100.00	70.67	72.17
Average per cent. digest'd		62.22	53.55	69.14	60.23	48.83	71.49	48.70	100.00	68.16	70.01

Mean nutritive ratio of crimson clover hay, 1: 3.76.

working. This is often a dry time, and the hay can be quickly and easily cured. It may often be best to sow this clover with oats, rye or barley, and cut all for hay in April or May, as above.

This clover will thrive on land in moderate condition, but, like some other forage plants, will pay best where given a rich soil.

The high protein content, large proportion of amides and narrow ratio are especially noticeable in this hay. It is so rich, that for any use, it may well be fed with some such fodder as straw, meadow hay, or cotton-seed hulls. When fed for production of milk, the addition of corn, or corn and oats, will tend to widen the ratio, and probably add to the good qualities of the product.

*8. *One-year-old crimson clover hay.*—The digestibility of a portion of this same lot of hay was determined when new and reported last year. Its digestibilty was re-determined a year later to see if it had changed in composition and digestibility, and to be used in other experiments. The old hay had suffered a loss of 1 per cent. in nitrogen compounds and slight changes in other constituents, but there was very little difference in the digestibility of the two hays beyond a small decrease in the digestibility of the fats and nitrogen-free extract of the old hay.

9–10. *Rations of crimson clover hay and cotton-seed meal.*—The digestibility of four rations of crimson clover hay aud cotton-seed meal were determined, viz.: 6.4 to 1, 3.53 to 1, 3.5 to 1, and 3.09 to 1. They were all digested well and make good showings for the rations, but they are too heavy for ordinary feeding. Their digestibility were determined to arrive at the digestibility of cotton-seed meal, which could not be fed alone, and the results obtained for this latter material confirm our high opinion of it as being our most valuable concentrated food.

15. *Rations of crimson clover hay and corn meal, 2.36 to 1 and 1.83 to 1.*—These rations have a very high rate of digestibility and the proportion of nutrients in them are good, far better than in corn meal alone, and would be good rations for milk, for first period of fattening of steers, or for horses or oxen at work.

17. *Rations of crimson clover hay and corn-and-cob meal, 1.8 to 1, and 1.35 to 1.*—These rations have quite a high rate of digestibility, and the proportion of the food constituents in the ration of 1.8 pounds hay to 1 pound corn-and-cob meal are such as to recommend the ration for the same purposes as given for the rations of crimson clover hay and corn meal in paragraph 15. The nutritive ratio of the ration of 1.35 pounds hay to 1 pound meal is rather wide for most feeding purposes.

†Crimson Clover for Hay or Seed.

Crimson clover (trifolium incarnatum) is known under a variety of common names—Annual, German, Scarlet, and Italian. This clover is easily grown, and should come into quite general use. It is an annual, and consequently must be re-seeded for each crop, which makes it important to grow seed at home. Seed may be sown from July to October, but the land should always be well prepared for it, or, if not, it should be well shaded, as under a growth of cow-pea vines, or in a corn or cotton crop, where the seed should be sown when the crop is laid by. Grown in this way it may be of great service in enriching and holding the land from washing. Its growth is made in the cool, wet part of the year, and it is ready to be made into hay at the season when planters are waiting for cotton to vegetate for first working. This is often a dry time, and the hay can be quickly and easily cured. It may often be best to sow this clover with oats, rye or barley, and cut all for hay in April or May.

This clover will thrive on land in moderate condition, but, like some other forage plants; will pay best where given a rich soil. The composition of crimson clover hay shows it to be a highly nutritious food. It is so rich that for any use it may well be fed with some such fodder as straw, meadow hay, or cotton-seed hulls. When fed for production of milk, the addition of corn, or corn and oats, will tend to add to the good qualities of the product.

The seed distributed in 1893 by the N. C. Experiment Station is part of a crop of 2,687 pounds from 1⅜ acres, which is at the rate of 1,956 pounds of seed in chaff per acre. We have made some tests on this, which if true for the whole lot of seed, would yield at the rate of 757.95 pounds, or 12⅝ bushels per acre of clean seed. This seed usually sells at retail for ten cents per pound, and dealers are now paying $5.50 per bushel for it. The long, well-filled heads warrant this a good cash

*Bulletin 97.
†Press B. 51 also reprinted in No. 61.

crop where a good stand can be secured on land in fair condition. It can be grown in orchards for the improvement of the soil, as in Delaware, where it has come to be a standard crop. The one drawback is that a special machine must be used to clean the seed. A clover seed huller is expensive, but could clean the seed of a whole township, and perhaps a whole county, by moving around as is usual with threshing machines.

There are several advantages in growing annual clover sufficient to induce its cultivation from purchased seed, but if, instead of buying seed, it can be grown at a profit and add one more to the cash crops, how much better to take such steps as will insure its general planting.

In maturing a crop of seed care should be exercised to pull out weeds and foreign plants, and so keep the seed clean. Let the clover get ripe, but not so as to shell out too freely before cutting, and handle as little as possible. Pitch up into cocks from the swath and draw in from the cocks in tight wagons. If tough the cocks may be turned over from the bottom a half hour before drawing to shelter. House on a tight floor and thresh out at the first opportunity after the straw has dried out enough to thresh well.—*F. E. Emery, Agriculturist, N. C. Experiment Station.*

Crimson Clover Seed Distributed in 1893.

The Experiment Station having on hand last year (in 1893) Crimson clover seed which had been grown on the experiment farm, offered through the press of the State to distribute to applicants who would pay transportation charges and would make careful trial of same, enough seed to plant ¼ acre. There were 1586 persons who applied for the seed, far more than the Station could supply, unfortunately. Indeed a quantity of seed had to be purchased to send as many as was supplied. The first 426 names received were sent the seed. To others full explanation was given as well as at what points the seed could be procured. Replies regarding the test are now coming in and tend to show that wide-spread information has been given in regard to this most valuable forage crop, and much interest has been created in its cultivation.

Experiences With Crimson Clover.

Just now the Experiment Station is receiving a lot of varied, but interesting information in relation to growing this plant from the farmers to whom seed was distributed last year. Brief directions for every step in growth of the crop were sent with the seed and the call for this information contains specific inquiries as to the various processes which help in studying the effect of preparation of soil in different sections of the State.

That the crop has been found all the Station claimed for it so far, by some farmers is shown in the following report from Vance county:

"Grown on stiff red land in very good condition. Broken with two-horse plow and harrowed with a Gayle harrow. Harrowed the seed in with same implement, October 4th, or 5th, '93. The amount of seed used was 3 pounds cleaned, and it was put on ¼ of an acre. No fertilizer was used except a dressing of tobacco stems after the clover came up. The clover started well, and continued to grow off well until injured by the March freeze. It has not been grazed but is now being fed green on the soiling system. I think it a splendid feed and will sow several acres this fall if I can get the seed. Think it would be better sown in August or September. I send herewith a specimen which I think is about an average stalk, as it is very uniform and very thick."

The specimen was 26 inches long; the head 2 inches. ⅓ of the piece or 1-9 acre like it should produce seed enough for 5 or 10 acres, or enough if clean, to bring $10.—*F. E. Emery, Agriculturist, N. C. Experiment Station.*

*Clover Seed Cleaned and in the Chaff.

As farmers sometimes wish to purchase clover seed in the chaff, or sow home-grown clover seed without hulling it, the relative value of the seed in these conditions should be understood. Examination of several samples of such seed at the N. C. Experiment Station gives the following results:

*Miscellaneous B, No. 96, p. 80.

One hundred seeds of red clover in the hull weigh 0.40 gram. The hulls of 100 seed weigh 0.10 gram. The weight of the hulls is ¼ or 25 per cent. of the total weight of unhulled seed. Out of 100 apparent seeds in hull 28 seeds had no germ. Out of a weighed sample of unhulled seeds ¼ the weight was chaff, dirt and weed seeds. In a sample of choice cleaned clover seed we expect to find the viability of seed 95 per cent. Real worth 90.25 per cent. Assuming that in the unhulled sample as great a per cent. of true seeds will germinate as in the sample of choice cleaned seed, we calculate the real worth of this sample as 38.85 per cent. Therefore, in purchasing clover seed in the hull the price should never exceed 40 per cent. of the price of choice hulled seed.—*Gerald McCarthy, Botanist N. C. Experiment Station.*

*Sowing Crimson Clover on Weedy Land.

We have a piece of strong land on a river bank on which there is a very rank growth of weeds. We wish to know your idea of growing annual clover on this land; what preparation should be given and how should the seed be sown.

Corinth, N. C. T. R. P.

(Answered by F. E. Emery, Agriculturist North Carolina Experiment Station.)

If it were not for seeding with the weed seeds you might sow the clover among the seeds broadcast, if the soil is light, and save working the soil.

It will be best to mow the weeds or roll down with a heavy roller a few days in advance of plowing in order to let them partially dry out, and not endanger sowing the land by turning down a great mass of green matter, fermenting in it. Plow well, harrow smooth, sow clover seed broadcast at the rate of fifteen, eighteen or twenty pounds per acre of clean seed, or forty to fifty of chaff per acre. Then drag with a light brush, smoothing harrow, or a plank with a chain attached to both ends and the singletree, so the plank will cover nearly its whole length on the ground. Watch your field, so if seed germinates and is killed by hot weather or insects, you can re-harrow and re-seed.

Crimson Clover in 1894.

(A crop of seed $44.61 per acre.)

It is worth while to spread the fact to every farmer that this clover can and will bring dollars to him if he will but grow it.

This crop starts and grows to full maturity and dies between August and the following June. It will start among corn, cotton, or other crops, and need not interfere with the crop for the latter part of the season in which it is sown. When the summer crop is gone, crimson clover takes the soil and, provided it is not too poor, covers it with verdure and increases its fertility while preventing the unsightly washing which frequently occurs without its presence. It only holds the ground for a short time in spring against other crops. If grazed, no delay need be experienced in plowing for early crops, but we would plow all other ground first, as the later this is left the more good it will do stock and land, and the better it will be for the following crop.

If it is made into hay the last of April will see it harvested and the weather will be propitious for hay-making. Indeed, it may well be questioned if it would not be better, for a cotton crop, to have the land in this clover for hay to cut at the time when cotton has usually hardly started in sickly yellow growth, and then turn the land at once and plant the cotton. The roots and stubble will have mellowed the soil and added a rich supply of plant food to push the cotton crop and save a heavy bill for fertilizers. If the crop is late it will doubtless make up the time in more rapid growth, and if it is not quite so far advanced when bolls begin to rot some years in August, it may be as well for the crop. At any rate corn can be planted after crimson clover has been cut for hay or seed, and will find its best development after such a crop.

Now is the time to purchase seed and start to growing this valuable crop. Seed is cheaper than for years before. We would advise those who start to at least save their own seed.

To show some of the possibilities in this crop, a statement is appended of the crop grown on the Experiment Station farm in 1894. This is only what any farmer may equal or exceed, but it shows a profitable use of land for the winter months

*Miscellaneous bulletin No. 96, p. 75.

Of four acres in clover 2½ were harvested in good order while 1½ acres were storm-beaten when ripe. The yield of seed in hulls on the unhurt portion was 1,487 pounds per acre, valued at 3 cents per pound, a total of $44.61 per acre. On the storm-beaten portion the yield was 581 pounds per acre with a value of $17.43 per acre. This straw has been fed just as though it were prime hay, and teams have worked as usual on it with usual grain food. Corn crop on the land is now better because clover has been grown there. After the clover was cut off, the land plowed well, although elsewhere it was rather too dry to plow. The soil was darker colored than before and harrowed easily to a fine seed bed. We could but consider this soil permanently improved.

A great quantity of seed has been grown in Delaware this year and growers are advertising it for sale at very moderate rates. F. E. Emery, Agriculturist, North Carolina Experiment Station.

ERROR IN REPORT OF CRIMSON CLOVER SEED YIELD FOR 1894.

A recent press article gave the crop of seed for this year grown at the Experiment farm at $44.61 per acre When this statement was made a portion of the field recently added, was unintentionally omitted from the calculation of the yield. We hasten to make the correction. This increased area would reduce the value of seed to $31.86 per acre. However, if the straw were included, the total value would be about as first reported.

The crop of unhulled seed in 1893 was 1,956 pounds per acre, which at the low price realized this year, would amount to $58.68 per acre, or $18.07 per acre more than the crop for 1894 as first reported.

The loss by weather-beating amounted to $14.43, which is enough to emphasize the necessity of employing every means possible to save the crop in good weather. On this point the Experiment Station expects to have a seasonable article for next spring before the seed is ripe.—F. E. Emery, Agriculturist, N. C. Experiment Station.

II. CRIMSON CLOVER AMONG NORTH CAROLINA FARMERS.

In ths spring of 1893, the Station harvested a crop of crimson clover seed from 1⅜ acres. Except what was used for seed this crop was distributed to as large number of farmers who made application for it and agreed to pay freight on the same. The crop was sent out in 10 and 5 pound lots in chaff. Later, several bushels of cleaned seed were purchased and distributed in two-pound lots. The seed was exhausted before one-third of the applicants were supplied. In the following spring an Information Bulletin (No. 4) was sent out to the addresses to which seed had been sent. There were 430 of these. Eighty-one replies have been received, and these have been tabulated and furnish the basis for the following:

It may be well to note that 19 out of every 100 to whom seeds were sent have reported.

Of these 81 reporting, six failed to get the seed sent; 50 report having received seed in chaff, 22 clean seed, and three do not specify. The following amounts are reported as having been received: One 30 pounds, two 20 pounds, one 15 pounds, twenty 10 pounds, one 8 pounds, thirteen 5 pouuds, one 4 pounds, one 1 bushel, eight chaff, amount not specified, three 2½ pounds, one 1 quart, two three pounds, ten 2 pounds, two one pound.

Those who report more seed than was sent to one individual, either by accident or agreement, had and reported on the seed intended for two or more farmers.

QUESTIONS ASKED.

The questions asked of each man to whom seed was sent were as follows:

1. (*a*) When did you receive the seed?
   (*b*) Was it in chaff or cleaned?
   (*c*) How many pounds?
2. (*a*) What was the character of the land on which this seed was sown?
   (*b*) What was its condition and what preparation was made for seed?
   (*c*) On what date was seed sown?
   (*d*) Was it harrowed, brushed, rolled, or either, after sowing?
   (*e*) What was the area sown?
   (*f*) What fertilizer, if any, was used, and how much?
3. (*a*) Did the clover start well? Has it continued to grow well?
   (*b*) If not, what do you think stopped it?
   (*c*) Have you grazed the plot? If so, how much?
4. If made into hay, please report how much hay was realized from the plot.
5. If it was saved for seed, thresh as soon as dry and report as early as threshed how much seed in chaff you secured by following the directions which were sent with the seed.
6. What do you think of this clover? General remarks.
7. Fill out this blank and return as soon as possible, so you will not forget it, and we can have your data for use with other matter like it.

SUMMARY OF REPLIES.

Taking the replies up *seriatim*, most of them indicate that the seed was promptly delivered, though a few lots were delayed and some two or three lost. As noted above, a few used seed intended for several farmers. As to the chaff, or cleaned seed, it was expected some light might be thrown on which would prove best in farmers' hands—cleaned seed or seed in chaff. Answers on this point will be considered under several heads, thus: Of the number reporting from cleaned seed received, 82 per cent. report that the clover started well regardless of time sown, kind of land, or other conditions. Similarly, from chaff sown, 76 per cent. of replies were that the seed started well; 12 per cent. reported adversely for various reasons, and 6 per cent. of replies were indeterminate on this point. These percentages must be regarded as very favorable for a new crop in unfamiliar hands. The replies are so various as to kind of soil, that it is not feasible to put them in percentages. They vary from stiff red clay to "nothing but sand," and the many successes are well distributed among the various grades, whilst the few failures were also distributed from sand, upland, to mica clay, some sand, and on to stiff red clay. One man says: "It will not do on red clay hills; maybe on bottom lands it will succeed." It has succeeded, in the majority of cases, on all kinds of lands, as reported by those gentlemen who have so kindly complied with the Station inquiries by filling and returning the blanks sent out to them.

Under the inquiry as to condition and preparation, part reported condition good; others reported on condition and plowing and har-

rowing; while others left out condition of land and confined report to the work done in preparing seed-bed. It appears that at least half the reporters plowed the land, while many others found it only necessary to harrow it. In a few cases the condition of soil, and its preparation, are not given, while in most of the cases the preparation was well done. The clover was left on the surface, brushed, or rolled, and harrowed in. In five cases out of seven, where definite information is given where seed was sown, it grew well without covering by any of the means named; where brushed in, thirteen out of fifteen cases started to grow well; where rolled, eight out of ten cases; and where harrowed in, there were four, perhaps five, in thirty-two which did not start well, for some cause. At least five out of six did well.

On the kind of fertilizer used: A few report bone, ashes; eight, some form of commercial manure; twenty-four, stable manure—three of whom report failure, from Alamance, McDowell and Polk counties, two from September seeding, the other not specified, and on apparently good land, well prepared; twenty-nine report no manure used, and of these only two were failures, and one of these followed clay peas on red clay, and the ground was not harrowed.*

The reporter ascribes the failure to not having harrowed in the seed, but dry weather was mostly responsible, as in wet weather these seeds do hold when thus sown, and on some moist fields they are commonly sown that way. One failure was said to be from a freshet soon after sowing, and the others were nearly all ascribed to dry weather soon after the seed were sown.

Fifteen reporters had grazed the plot of crimson clover from a "very little" to "continually" and a "great deal." Some began to graze in October, some in January and February, and one from Onslow county reported having grazed "all winter."

There were very few reports as to amount of crop harvested. Only two gave definite amounts. These were 600 pounds hay from 20 pounds chaff on one-fourth acre—1 and 1-5 tons per acre: from 2 pounds clean seed on one-eighth acre, which yielded 200 pounds hay from one-half and 45 pounds stripped seed from the other half. This was at the rate of 1 and 3-5 tons of hay or 720 pounds of seed in the hulls—about 6 bushels cleaned—besides the straw, which can be plowed in and becomes a valuable manure, or it can be used for hay, and is quite valuable for such use.

The general remarks were almost all favorable to this clover, though some prefer red clover. The heavy freeze of the last of March, 1894, did much damage to the plots, as 31 reports from 14

*The Station Agriculturist has sown seed of crimson clover among peavines broadcast and in rows on red clay loam and sandy s tuations, and watched the development of the germination of the seed by dew and showers, and has seen the radicles dry up in the hot, dry September weather before they could effect an entrance into the encrusted soil of the clay, or penetrate deep enough into the looser dry sand to secure food and water.

counties mention the freeze as having done harm to the crop. These counties are: Alamance, 3; Alexander, 1: Anson, 1; Cabarrus, 11; Durham, 2; Guilford, 3; Iredell, 2; Lenoir, 2; Mecklenburg, 5; Moore, 1; Onslow; Vance, 4; Warren, 1; Wake, 4. A few reports gave favorable comparisons of crimson clover compared with white and red clovers after the March freeze. The crimson clover was injured very much less and grew up well afterwards.

REPORTED FAILURES.

The reported failures have been more carefully examined than the successes. They are few, and if the causes can be avoided, no great losses need be incurred and the danger of loss may be reduced to almost nothing, except an occasional re-seeeding:

a The first failure reported was from sowing seed on the surface among peavines, which was followed by dry weather. Sowing after peavines should be done in the beginning of Dog Days, when there promises to be showers frequent enough to start the young plants. There must not be too dense shade from the peavines, else there will be danger of failure. Very heavy vines should be mown for hay and the seed sown on stubble, after which a harrow may be safely used.

b The second failure was probably a lack of sufficient "stand" to cover the ground, due to dry weather soon after sowing, as no other fault can be found from the report, which was made when the clover was in bloom, 31 inches tall. This reporter says: "It did not start well," and "has not grown." "Have not gathered seed." "Just in bloom, 31 inches high." "It is not much, unless it gets better." But he qualifies this by observing that the land may not suit this clover.

c The third failure was ascribed to dry weather soon after the seed was sown in September. The little which grew did well.

d Fourth failure was apparently from same cause. "Did not come up well. Scattered plants have done well. Neighbors have good plants from purchased seed."

e Also the fifth is reported not to have started well and to have been injured by drought in April and May. The latter, doubtless, due to having been sown late in November. Should have been cut for hay in April in the eastern location, if started by October and not grazed. The dry weather of April would then suit the hay-making.

f The sixth and seventh failures are obvious and need no comment. In these cases the clover seed was sown in November with wheat.

h The eighth was due to freshet, which probably washed away the seed.

i The ninth failure was from Rowan county. The seed was put on good, well prepared, well manured land and was harrowed in. Failure must have been due to *too deep* covering, or hot suns when coming up. This reporter mentions a good piece in Cabarrus county, not otherwise heard from.

The reports which have been reviewed to secure the above notes on crimson clover, came from the following counties: Alexander, Bladen, Buncombe, Cabarrus, Chatham, Edgecombe, Franklin, Granville, Henderson, Johnston, Martin, Onslow, Orange, Pasquotank, Pender, Pitt, Polk, Robeson, Union and Wilson, one each. Anson, Burke, Davie, Halifax, Iredell, Lenoir, McDowell, Moore, Richmond, Rowan, Sampson, two each. Alamance and Warren, three each. Durham and Guilford, four each. Mecklenburg, seven. Vance, eight, and Wake nine.

Although less than half the counties are covered by the reports, they came from nearly all the sections from the east up into the mountains, and indicate that this crop can be successfully grown all over the State.

CONCLUSIONS GENERALLY FAVORABLE.

The Station has advised previous to this, and continues to advise early seeding. There is a better chance to secure a stand of clover, and if one seeding is followed by such dry hot weather as to cause a failue there will be time to reseed the land. The early sown crop may be grazed, and will be ready for hay earlier than a late sown crop which requires favorable winter weather, or a late spring in order to mature well.

There are many words of praise and commendation for this crop from different parts of the State for grazing, for cutting to feed green and for hay. Our own digestion experiments have proven the hay from crimson clover, when well made as was the case in the digested hay to be richer in digestible food than any other clover which had then been subjected to experiment in that line. It is, however, as a seed crop, and a soil improver that we would urge its growth on a large scale. Crimson clover seeds freely. It is capable of adding materially to the incomes of the farmers of every county and at the same time to be helping to increase the fertility of the farms if grown extensively enough to warrant the purchase of hullers to clean the seed for sale. To improve land, this clover is probably next to the cow-pea in value, and should follow the cow-pea and not be used on poor land until the cow-pea has begun an improvement which this crop can be used to continue. It is being grown regularly at the Experiment Farm. At Biltmore this spring we saw a very heavy crop of it being fed to the Jersey cows green, and hay was being made of it. The crop is worthy of the careful attention of every farmer in North Carolina.

Little care and no cultivation after sowing is needed to grow this crop. It grows from fall to April or May, and may succeed a corn crop and leave the ground in season for corn to be grown on the same land as regularly as if it were left bare between the crops of corn. It can be grown the same in cotton fields if grazed off instead of making hay or seed which could not be harvested from among the cotton stalks. Apiarists will find this clover the delight of their colonies, and can greatly extend the season for its blooming by judiciously grazing plantations of crimson clover. We dare not say all that might be said for this crop, but will be content to finish this paper with some notes for those who have no experience with it.

GENERAL HINTS.

The seed is for sale by all leading seedsmen in the Eastern and Southern States. The time to sow this seed is from last of July to December. The later sowing can give satisfactory results only when followed by very mild winter, or late wet spring. The Station has scored its best successes with July and August seeding. It advises preparation of the soil and light covering, though some growers near by, only sow it broadcast in stubble land and give it no further attention, until it is ready to be grazed, local climate and kind of soil determines this point. Mown for hay, or cut for seed, crimson clover *without a nurse crop* will probably be fit to graze as early, or earlier, than any other clover. It will be in a stage to be made into hay by April or early in May as the seed will be ripe during the last half of May. If cut *early* for hay a light seed crop can be taken in June from good land. When made into hay, cut it early for several good reasons.

A clover seed-huller is necessary to clean the seed, and one of these machines is capable of threshing 100 to 150 bushels of seed per day, and cleaning it ready for market at one operation. This is the only extra machine needed, as the seed can be cut by mower or reaper and should be hauled in wagons covered with canvas, directly to the thresher, or stored in places where the shattered seed can be saved. The huller costs too much to be afforded by any but those who have very large areas under cultivation, unless by co-operation, a number of farmers in a town, or county, can agree to buy one together. The cost will be $400 to $550, and for suitable power to run and move it if portable, or traction engine perhaps, $500 to $700 more.

We are credibly informed that the farmers of Delaware, in the center of the seed-growing belt, have purchased from one to two dozen new hullers per year, and may have exceeded the higher figures since our information was obtained.

III. SERIOUS LOSSES FROM FEEDING OVER-RIPE CRIMSON CLOVER HAY.

Under the head "Crimson Clover Hair Balls," F. V. Coville (U. S. Dept. of Agric., Division of Botany, circ. 8, pp. 4, figs. 3), has called attention to death among horses from eating over-ripe crimson clover hay. We have not seen the circular, but a brief review of it is given in Experiment Station Record, Vol. VIII, No. 7, p. 623.

The following contains some North Carolina experience with over-ripe crimson clover hay, first published in THE BULLETIN as per request:

CRIMSON CLOVER FOR HORSES.

DEAR SIR:—Find enclosed a deposit from a horse which has been fed on annual or crimson clover for about thirty days. He is now sick, and I am doctoring him for same. It was about two and a half inches in diameter. Please analyze and give information accordingly. H. B. H., JR.

Afton, N. C.

DEAR SIR:—I send you to-day a ball that was taken from the intestine of a fine mare, about eight inches back of the stomach. This was the one which caused death, as there was mortification at this point. There were three other balls in the stomach.

This mare had been fed only on crimson clover hay and corn. Will you please examine it and write me the cause and a remedy? Also publish it in THE MONTHLY BULLETIN. J. L. A.

Glenview, N. C.

ANSWERS BY FRANK E. EMERY, AGRICULTURIST NORTH CAROLINA EXPERIMENT STATION.

The ball received seems to be a mass of the calyx-teeth, and the hairs surrounding the same, which you may find at the outer end of a clover blossom. When the seed is nearly, or quite ripe, these become somewhat stiff, and have a tendency to form into masses.

Sometime ago the United States Department of Agriculture issued a bulletin, warning against the use of over-ripe crimson clover hay for horses and mules, because of the danger of death from the balls, such as you have found.

At this Experiment Farm there has been considerable chaff and straw fed, also hay, but the hay has been cut too early to have any dangerous stiffness in the calyx-teeth, and the stiff calyx-teeth surrounding the ripe seed has been removed from the chaff and straw which has been fed. Another cause for immunity from disease, when straw and chaff have been fed, must have been in the method of feeding. Corn silage has usually been fed twice daily, and the straw or chaff only once, at night, when the animals had abundant time for mastication, while the previous day's feed must have been carried along in the stomach and intestine by the mass of succulent silage, so far that no mass from two or more feeds ever could accumulate. This method of feeding, then, should commend itself to owners and feeders of horses and mules. In over six years' experience feeding silage to three animals, nearly as long as any silage has been on hand to feed, no mule or horse has lost a day's time by any kind of sickness, and there has been only two times when a trace of sickness could have been caused by food.

One mule has on one or two occasions exhibited symptoms of colic from greedily taking more than his share from the feed which he shared in common with his mate.

1. If crimson clover gets over-ripe make it into seed to be sown.
2. Well cleaned straw and chaff are fairly free from dangerous calyx-teeth.
3. Feed the dangerous hay, if at all, with about alternate feeds of green forage.
4. Be very careful to cut hay early enough to be free from danger.

IV. EARLY AND RECENT INTRODUCTIONS OF CRIMSON CLOVER INTO NORTH CAROLINA.

Very recently, during the past summer, an advertiser in agricultural papers has been offering crimson clover seed in North Carolina as below noted. The letters relating to this have appeared in the paper in which we saw the advertisement of the seed and the commentary was accepted for THE BULLETIN for November, 1897.

CRIMSON CLOVER.

Correspondence of the Progressive Farmer.

Crimson clover is a native of Italy and other parts of Southern Europe. It was first introduced in this country several years ago by the late Dr. Havadine, a florist of Delaware. Being a great lover of flowers, he was attracted to this plant by its beauty, which is hardly exceeded by the finest flower that adorns yard or garden. The beautiful deep green which may be seen all through the winter, when not entirely covered with snow, grows deeper and brighter as spring advances, until early in May, when the flowers appear and the field changes from a deep green to a brilliant crimson, making a sight to behold and to remember. At first its value as a forage plant was not understood, and as a soil restorer it was unknown, and the progress of the plant at first was rather slow. Everyone admired its beauty, and numerous plots were grown for ornamental purposes, but years elapsed before farmers awoke to its value as a regular rotation crop. Crimson clover is now successfully grown in all parts of the Union. It is good for hay; yields two to three tons per acre. It is valuable for seed, which it produces in large quantity; makes a good fall and winter pasture and is a good bee plant; the honey is very white and of excellent quality, but its greatest value lies in its ability to store up plant food, and at the same time sends down its deep feeding roots far in the subsoil to gather and bring to the surface elements of fertility that would be otherwise lost. Crimson clover is an annual, and must be sown in its proper season; this extends from the first of July until the last of September. One peck of seed are usually sown to the acre.

If any of the readers of the *Progressive Farmer* would like to give this clover a trial, I will send them a trial package of seed free by mail if they will send me ten cents in stamps to pay postage. I would recommend sowing the seed in July or August if ground is ready. Every flower garden should have a bed of crimson clover, as the plant is strikingly beautiful. CARL B. CLINE.

Columbus, Ohio.

[From the Progressive Farmer of September 21, 1897.]

Correspondence of the Progressive Farmer.

Noticing the letter of Mr. Cline, I was struck by his offer to send crimson clover seed into North Carolina as a novelty crop farmers ought to be acquainted with. That Dr. Haverdine may have made an independent importation of this seed no one will deny, but that he should be accredited with having started this crop in the United States is absurd. "There is nothing new under the sun," and this clover may have had a dozen independent introductions before this writer, Mr. Cline, or any other reader of the *Progressive Farmer* was born. Here at Raleigh we have an unassuming farmer who made an independent introduction of crimson clover into this section by bringing a little seed in his trunk from England about twenty years ago. It has been grown by him and others ever since, but has never been as extensively grown anywhere in America as in and around Delaware within the last eight years. There the crop is properly valued as a land improver and as a cash crop for seed to sell.

Here in North Carolina crimson clover was known for at least forty years, as State Geologist Emmons makes some very accurate observations on it, though falling into the error that it required a cooler climate than is found in Eastern counties. It was perhaps grown in his time by sowing in spring. If readers respond to Mr. Cline's offer of seed as farmers did to another from the Experiment Station a few

years ago his seed will soon be exhausted. About $140 worth of seed went off like hot cakes, and then only about one-third of the names listed were supplied. A notice had to be given that supply was exhausted.

Readers of the *Progressive Farmer* will do much better and credit themselves to buy seed of some growers and enter into the cultivation of this clover on a scale large enough to afford a cloverseed huller in every county or town, and make cloverseed, instead of cotton or tobacco, one of the cash crops. It will pay in increase of other crops in rotation. It will pay in itself. It will pay in the increased number of cattle, sheep and swine which can be better kept on the farm, and each animal made to sell for more money than formerly without crimson clover.

FRANK E. EMERY.

[From the November BULLETIN.]

CRIMSON CLOVER SEED.

Who has tried Mr. Cline's offer of free crimson clover seeds for ten cents, to pay the postage? Don't all speak at once, but some one tell us how many ounces of seed he got for ten cents.

Remember, this is a farm crop, of which hundreds of bushels of seed may be grown on any large farm, and thousands of bushels ought to be grown and used for seed to improve "worn out" soils. How much fertility for ten cents from Mr. Cline?

One Man Has Tried It.—There came one day through the West Raleigh postoffice a little package to R. E. L. Crenshaw. It was from Carl B. Cline, Columbus, Ohio. It was crimson clover seed. It is in my office, where the editor can see it. There are two little packets, such as the Delaware farmers used to mail out sample packages of seed, which they raise to sell to their customers. If you write one of these farmers for quotation of prices and for a sample of seed, he will send you as large a sample and expect you to buy a bushel or two; or, say 100 pounds, at about five or six cents per pound. Some even send you directions for preparation of land, time to sow and what to do with the crop, or nearly this amount of information, with the seed when you purchase it from them. Not so with Mr. Cline. He is selling a novelty for which he must have a round price. The seed in the two packets weighed 25 and 26 grams. It takes 28.35 grams to make an ounce. Suppose when freshly put up and rather scantily weighed (so the added paper would bring the parcel under the United States postal law at two ounces), suppose, we say, it had been two ounces of seed. Ten cents, less two cents for postage, leaves eight cents for seed. The difference in weight can well pay for paper and clerk hire to put up and lick on the stamps, and Mr. Cline gets EIGHT CENTS FOR TWO OUNCES OF CRIMSON CLOVER SEED!

This is four cents an ounce, sixty-four cents a pound, and $38.40 per bushel. Don't it pay to advertise in the right way? Six-cents-a-pound seed raised to sixty-four cents! And this for a crop which ought to be as commonly grown as is corn and seed for home use and for sale as common as it is in Delaware.

Several years ago some one advertised a new coffee berry for seed—could be cultivated anywhere, made a good substitute for coffee, yielded well, etc., etc., all of which was true of the soja or soy-bean, the kind of seed which was being advertised for sale under the new name of coffee berry at twenty-five cents per pound. I believe the advertiser requested money or stamps for postage. He should have planted his first few crops and come out after this later illustrious seedsman has paved the way for greater wealth under legitimate names.

FRANK E. EMERY,
Agriculturist N. C. Agricultural Exp. Station.

State Geologist Emmons, in his second report, addressed "To His Excellency, Thomas Bragg, Governor of North Carolina," (date of letter of transmittal, March 1, 1858), said of this clover:

"CRIMSON CLOVER (*trifolium incarnatum.*—In some parts of this country this clover would no doubt succeed. It, however, requires a climate rather cooler and moister than that of the eastern

counties. But in the mountainous section of the Southern States it can hardly fail of being received with favor. The advantages arising from its culture are, it may be sown after potatoes are secured and produce a spring crop which which will be earlier by eight or ten days than lucerne or red clover. It produces two good crops in one year. It is, however, an annual, and it requires as much care to insure success as the red clover. For soiling cattle it is well adapted, in consequence of its early growth. If cut for hay, it should be gathered as soon as it is in flower. The seed may be obtained from the second crop. As a general rule, where red clover succeeds, it may also be expected that crimson clover will succeed also."